Irving Martinez

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EDUCATION

Emory University
PhD in Mathematics
Atlanta, GA
Aug. 2018 - Aug. 2023

Emory University
Master of Science in Computer Science
Atlanta, GA
Aug. 2018 - Aug. 2023

University of Cambridge
Visiting Student in Applied Mathematics Tripos Part III
Cambridge, United Kingdom
Oct. 2016 - June 2017

University of Texas at El Paso
Double major in Physics and Applied Mathematics; GPA: 3.83
El Paso, TX
Aug. 2011 – Dec. 2015

RESEARCH AND WORK EXPERIENCE

Aarhus University
Postdoctoral Researcher
Aarhus, Denmark
August 2023 - Present

- **Applied mathematics and image analysis in mechanobiology and biochemical structures.** Heavy usage of image analysis to understand foam porosity, mechanobiology, and composition with the aim of understanding cell behavior under the influence of external environments. **Meshing algorithms to incorporate the influence of nanopores in porous media and to bridge microscale and nanoscale simulations** are soon to be submitted for publication. Additional objectives include the digital recreation of synthetic materials without relying on physical experiments and the obtention of stochastic insight. Project is supervised by Dr. Ute Hahn and Dr. Jens Vinge Nygaard and supported by a Villum Synergy grant from the Velux Foundations.
- **Main Skills: Python, MATLAB, COMSOL, NASTRAN, Meshing, CFD, Simulations, Stochastics, Probability, Algorithms, Imaging.**

Emory University
PhD Mathematics
Atlanta, GA
August 2018 - Present

- **Applied and numerical partial differential equations in cardiology.** Implementation of finite element methods and numerical PDEs to understand **fluid dynamics of coronary stents**. Other projects include analysis of aortic dissection via PDE-based image processing. Work was supervised by Professor Alessandro Veneziani.
- **Main Skills: Python, MATLAB, NGSolve, FEniCS, Navier-Stokes, Advection-Diffusion, FreeFem, Meshing, CFD, Simulations of Coronary Stents, Imaging, PDEs, Numerical Analysis, Multiphase, Multiscale**

Sandia National Laboratories
Researcher
Livermore, CA
May 2022-August 2022

- **Object detection, image processing, and machine learning applications in nuclear energy.** From a computational science perspective, I researched bubble movement in matrices of uranium dioxide nuclear pellets for better understanding and control regarding their release yield and overall thermomechanical stability.
- **Main Skills: Python, Mathematica, Algorithms, Object-detection, Probability, Machine Learning, PyTorch, Nuclear Physics, Imaging, Thermal Dynamics**

Met Office
Visiting Scientist
Exeter, United Kingdom
June 2017 - Aug. 2017

- **Detection of clear-air turbulence.** Using mainly R and Python, data mining and mathematical analysis were implemented to create algorithms to detect the presence of clear-air turbulence as experienced by aircrafts in the United Kingdom with the purpose of finding safer air passageways. The algorithm had very good preliminary results, and it is currently being tested on flights across the United Kingdom.
- **Main Skills: Python, R, Statistics, Probability, Stochastics, Machine Learning, Aviation Data, Data Analysis**

- **BASF** — **Ludwigshafen, Germany**
  Research Assistant — *May 2016 - Aug. 2016*
  - **Mathematical modeling of fermentation.** Biological processes were modeled to investigate the optimal factors resulting in greater yield of produce. Neural networks were successfully developed along with partial differential equations to predict the behavior of fed-batch fermentation. MATLAB and FORTRAN were primarily used for this research.
  - **Main Skills: MATLAB, FORTRAN, Statistics, Probability, Machine Learning, Neural Networks, Data Analysis, ODEs, PDEs, Biochemistry**

- **University of Texas at El Paso** — El Paso, TX
  Research Assisstant — *Aug. 2014 - May 2016*
  - **Research on BCS-BEC crossover.** Performed research for Professor Efrain Ferrer and Professor Vivian de la Incera in high-energy physics and applications of quantum field theory. More specifically, the research focused on the BCS-BEC crossover for a system of quarks at high-energy densities considering the diquark attraction and vector-vector interaction. Mathematica was the main computing system used for this research.
  - **Main Skills: Quantum Physics, Mathematica, Data Analysis**

- **University of Chicago** — Chicago, IL
  Research Assistant — *June 2015 - Aug. 2015*
  - **Research on Z' peaks.** Worked with Professor Liantao Wang and Dr. Tongyan Lin in Collider Phenomenology with focus on New Physics at the Large Hadron Collider with dimuon invariant mass spectrum, where I helped discover the computational relationship between the size of Z' peaks and the coupling constant. I relied on Mathematica and Madgraph for this research.   Main Skills: Quantum Physics, Mathematica, Data Analysis

- **University of Texas at Austin** — Austin, TX
  Research Assistant — *June 2014 - Aug. 2014*
  - **Research in optics in nanoparticles.** Research in experimental physics with Dr. Xiaoqin (Elaine) Li with relevancy in metal nanoparticle plasmonics and control in nanostructures. The optical effects of electromagnetic radiation at the nanoscale were explored in systems of nanoparticle gold structures such as 2-by-2 squares and degenerate polygons. MATLAB was the primary computational tool, and the research resulted in the publication of an article in Nano Letters.   Main Skills: Optical Physics, Nanoscience, MATLAB, Photonics

Relevant Skills and Leadership Positions

- **Recent Skills:** Continuum Mechanics, CFD, FEM/FEA, COMSOL, NGSolve, FEniCS, Simulations, Stochastics, Probability
- **Graduate Level Classes:** Machine Learning, Numerical Analysis, Discrete Wavelet Transformations, Applied statistics, Electrodynamics, Analysis of Partial Differential Equations, Distribution Theory, Topics in Mathematics of Information, Boundary Value Problems for Linear PDEs, Quantum Mechanics, Complex Analysis, Numerical PDEs, Quantum Computing, Functional Analysis, Biomedical Imaging, Data Mining, Algorithms, Analytic Number Theory, Systems Programming
- **Programming:** Python, MATLAB, HTML/CSS, R, Mathematica, C, C++, FORTRAN, COMSOL
- **Languages:** English (Native Fluency), Spanish (Native), Italian (Reading), German (Reading), Danish (Reading), Portuguese (Reading), French (Reading), Catalan (Reading)
- **Leadership Positions:** Emory University Society of Industrial and Applied Mathematics. **President** (2021-2022) and **Vice-president** (2019-2021)

Teaching

- **Aarhus University** — Aarhus, Denmark
  Teaching Assistant — *Aug 2023-May 2025*
- **Emory University** — Atlanta, GA
  Full-time instructor of Calculus I and Calculus II — *Fall 2021, Spring 2022*
- **University of Texas at El Paso** — El Paso, TX
  Teaching and Research Assistant — *Feb. 2014 - May 2016*

Publications and work in progress

- **Liuyang Sun, Tzuhsuan Ma, Seung-Cheol Yang, Dong-Kwan Kim, Gaehang Lee, Jinwei Shi, Irving Martinez, Gi-Ra Yi, Gennady Shvets, and Xiaoqin Li.** The interplay between Optical bianisotropy and Magnetism in Plasmonic Metamolecules. Nano Letters, 16, 4322-4328, 2016.
- **Irving Martinez, Alessandro Veneziani.** Three Domain Decomposition Modeling, Simulation and Analysis of Blood Solutes in Stented Arteries.
- **Irving Martinez** Remeshing-free sculpting algorithms via reassignment for multidomain geometry modification. (Submitted)
- **Irving Martinez, Alessandro Veneziani.** Numerical model of drug eluting stents (DES) using domain decomposition. (In-progress)

Conferences

- **2023 SIAM Conference on Computational Science and Engineering Participant**
- **2022 World Congress on Computational Mechanics and Asian Pacific Congress on Computational Mechanics Symposium Keynote Speaker**
- **2021 SIAM Southeastern Atlantic Section Conference Participant**

Awards

- **3M (Three-minute) Thesis People's Choice Award**
- **DAAD Scholar** German Academic Exchange Service
- **University of Texas at El Paso Research and Academic Excellence Award (2015)**
- **Selected finalist for 2014 Notre Dame University NDConnect Undergraduate Research Competition** National Undergraduate Nanotechnology Symposium
- **College of Science Dean's List** Eight semesters
- **2012 COURI Symposium Participant**
- **Ciudad Juarez Municipal Award MAASS of Youth 2011** Most prestigious award given to a student of the region
- **Mathematics Olympiad**
  * Bronze Medal at Mexican National Olympiad (2010)
  * 4th Place State level (2010)
  * 2nd Place State level (2009)
  * 2nd Place Regional level (2008)
- **Intel ISEF (Science Fair)**
  * 1st Place Physics and Astronomy Regional Level (2010)
  * 3rd Place Sweepstakes Regional Level (2010)
  * 1st Place Physics and Astronomy Regional Level (2008)
  * 4th Place Physics and Astronomy State Level (2008)
- **Speech and Debate**
  * Qualification for National Individual Events Tournament (2014)
  * Qualification for National Individual Events Tournament (2013)
  * 2nd Place Informative Speaking at USAFA (2013)
  * 2nd Place Impromptu Speaking at State-Regional Level (2014)
  * 3rd Place Informative Speaking at State-Regional Level (2014)